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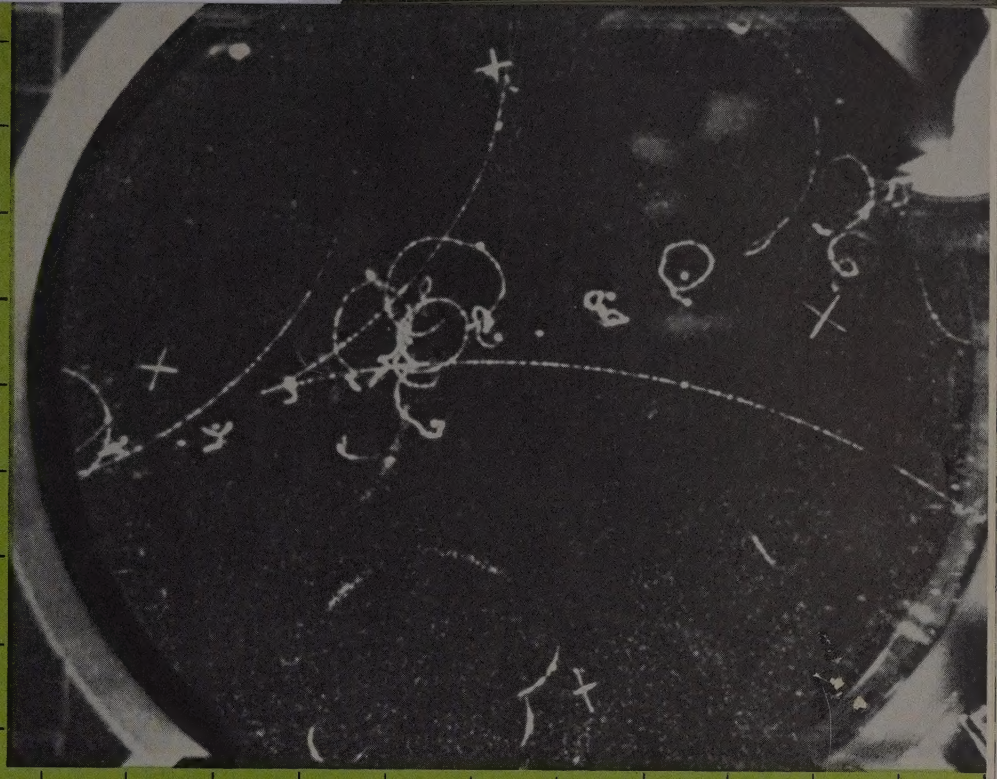

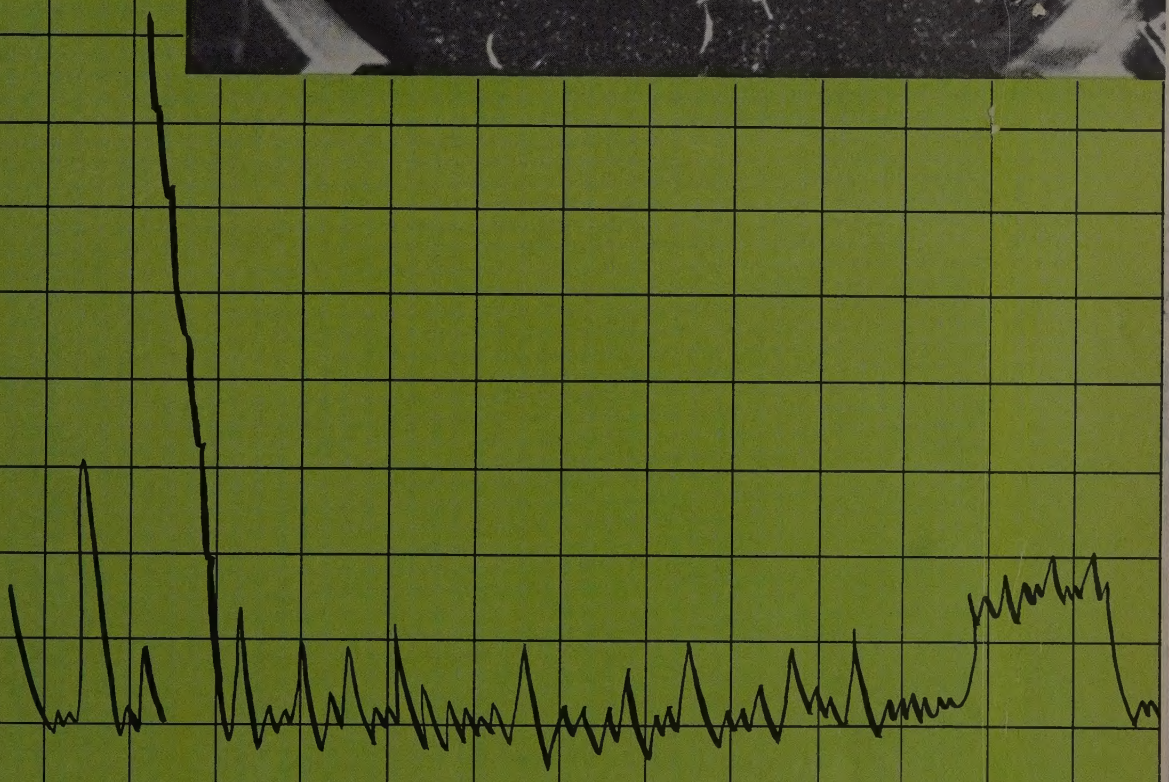

the **illinois technograph**

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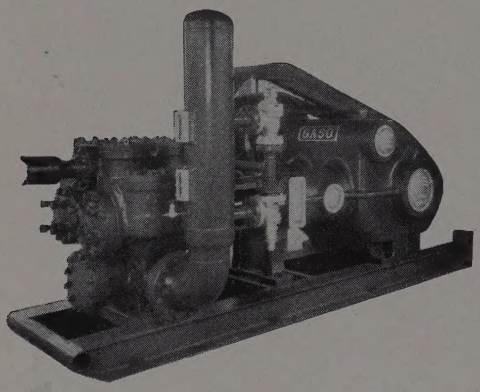

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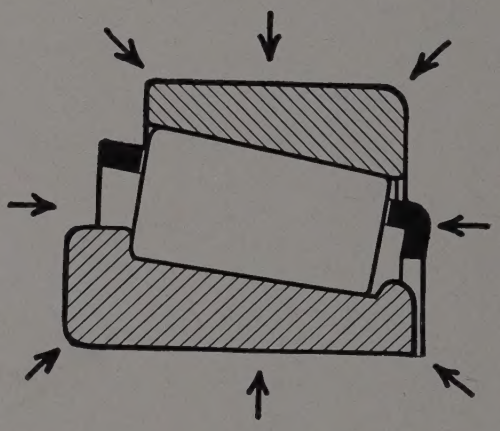

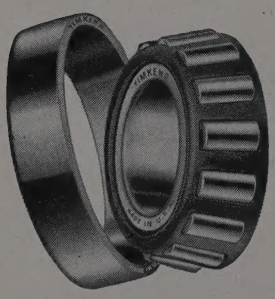

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volume 66 **number 6**

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our cover

This is a view taken in a Wilson cloud chamber, in operation at the 22 m.e.v. betatron in the Physics Research Lab. A gamma ray entering from the extreme left side of the picture passed near a nucleus and was transformed into matter — an electron and a positron. The curved tracks originating in the left center of the picture indicate the paths taken by these particles.

This picture was taken during the course of research conducted by H. W. Koch, now with National Bureau of Standards.

skimming industrial headlines

edited by Bob Hardin, E.E. '54

fireside sunbath

This bundle of loveliness is benefitting from simulated sunlight produced by the 20-watt fluorescent sun lamp developed by Westinghouse engineers. The tubular lamp emits a concentrated band of radiations in the mid-ultraviolet region of the spectrum (2800-3200 angstroms), which is the erythemal, or suntan-producing wave length. The portable fixture can be plugged into any standard electrical outlet. The fluorescent sun lamp is five times more efficient than sun lamps of previous manufacture, and has a life of more than 4,000 hours as compared to the 1,000-hour life of conventional types.

Simulated sunlight produces real suntan. (Courtesy of Westinghouse).

infrared chick brooders

Infrared heat lamps, which have baked many a sore muscle, now are keeping baby chicks warm.

In tests conducted by the University of Delaware, baby chickens were placed in a refrigerated room 12° F below zero, with infrared lamps as the only source of heat. It was found that the chicks thrived under the heat lamps, even at this low temperature.

In one installation on a poultry farm two hundred and twenty-eight lamps were placed 19 *in* above the ground; as the chickens grew and required less heat, the lamps were raised. The heat output of the lamps is regulated to the requirements of the chicks by a thermostat.

The new method excludes the danger of fire, and provides constant heat. The chicks do not crowd and injure each other, because they do not have to huddle together for warmth.

new antiseptic soap

An antiseptic liquid hand soap, containing the new chlorinated diphenyl methane compound, hexachlorophene, to help reduce bacterial flora on the skin, has been developed for the special use of food handlers and industrial workers.

The new soap contains both hexachlorophene and lecithin, an emollient and skin-softener, which helps reduce certain skin irritations caused by frequent hand washing. Because this new product removes a high percentage of many micro-organisms, and because it will help reduce the possibility of contamination being carried by the worker's hands to the food, it is particularly important to restaurants, and wherever food is handled. In the factory, the use of this soap will help decrease dermatoses and other skin lesions which may occur when workers are exposed to cutting oils, and other similar irritants.

The hexachlorophene in this new soap helps to protect hands from skin lesions and secondary infections resulting from minor injuries; the lecithin in this soap will help produce softer, less dry skin. Lecithin is a term applied to a group of phosphorized fats found in almost every living cell in both the animal and vegetable kingdoms.

fluorescent street lighting

The Detroit Public Lighting Commission has recently installed a completely new fluorescent street-lighting system.

Instead of the conventional globes, the new "white way" uses giant, 8-*ft*-long, tubular fixtures, developed by GE engineers. The fixtures are aluminum tubes in which two pairs of equally long fluorescent lamps are mounted. Two scientifically designed reflectors, mounted back to back in each tube, direct light from these lamps through clear plastic windows to the street.

The system is installed along a half mile segment of Wyoming Avenue, a principal north-south traffic artery. A total of 24 fixtures extend out from the curb on either side of the street.

The newly developed fixtures provide a bright, virtually glareless light, thereby contributing to easy and quick seeing, and adding to the comfort and safety of motorists and pedestrians alike.

Collectively, the four fluorescent lamps in each fixture produce approximately 19,000 lumens of light and provide an average lighting level on the street of about one footcandle. This is adequate for heavy pedestrian and vehicular traffic, because of the system's uniformity of illumination.

The fixtures are mounted 25 *ft* high on wood poles spaced at intervals ranging from 100 *ft* to 140 *ft*.

Give an athlete an inch and he'll take a foot. But let him take it. Who wants athlete's foot.

neutrinos . . .

ghost particles

by Jack Ullman, Eng. Phys. '51

Until recently, the freshman chemistry course at a small midwestern university was taught by a respected, white-haired old professor who was known among the students as the Great White Father. He was a fine old gentleman, though it was said of him that he had received his bachelor's degree in 1907 and hadn't learned anything since.

One day, after he had finished explaining the insides of the atom to his class, a bright, serious freshman raised his hand and asked where the neutrino fit into the picture.

The professor scratched his snowy head and looked questioningly at the student. "The neutrino?" he asked.

"The neutrino," replied the freshman, solemnly.

The professor remained puzzled for a moment. Then an understanding smile crossed his face. "Son," he said, "I think you'll find that it's pronounced 'neutron.'"

But you can hardly blame the professor for never having heard about the neutrino. Nobody has ever seen a neutrino, or seen the track of a neutrino, or figured out how to detect a neutrino. It has no charge and very little mass. It may even have no mass at all while at rest. As you might expect, it is rather hard to work with, so not much is known about it. One thing is known with considerable certainty, and that is that the neutrino has as much real existence as the electron, or the proton, or any of the particles that are supposed to make up our universe.

What Is It?

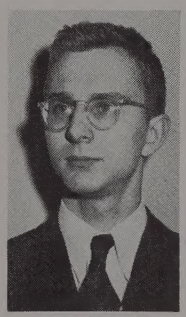
All the particles, principles, and laws in physics, or any other science, are invented for the purpose of explaining things that couldn't be explained without them. The neutrino was invented, or postulated, to use a physicist's term, in 1933, in order to explain some previously unexplainable things about a process known as beta decay.

As everybody knows in these atom-conscious days, the nucleus of an atom is made up of neutrons and protons. In the process of beta decay, one of the neutrons breaks up into a proton, which stays behind in the nucleus, and an electron (also known as a beta particle) which leaves the nucleus with a considerable velocity.

If you measure the energy of the nucleus before and after beta decay, you find that during the reaction it lost a certain definite amount of energy. You might expect this lost energy to show up in the form of kinetic energy in the ejected electron. If this is the case, all the ejected electrons would have the same velocity—the velocity which gives then a kinetic energy equal to the energy lost in the nucleus.

They don't, though. It was discovered that they have a whole range of velocities, from nearly zero right up to the velocity that was expected of them.

If an electron has less than the maximum velocity, then its kinetic energy is less than the energy lost by the nucleus and a certain amount of energy has vanished. This won't do. Physicists still have a lot of respect for the conservation of energy.



JACK ULLMAN

Jack is a senior in Engineering Physics. He came to this campus by way of Sullivan High School in Chicago and Illinois Institute of Technology.

His wide range of interests make him somewhat of a novelty as a prospective physicist; he is, besides a TECH staff member, the Technical Director of Illini Union Classical Music, Hours committee and his hobbies include music and ship model building. Back at IIT, he worked on Technology, was secretary of Illinois Tech Model Railroaders, and a member of the Physics Club.

So it was suggested in 1933, by Pauli and then by Fermi, that this missing energy was carried off by an uncharged particle of very small mass, which they called the neutrino.

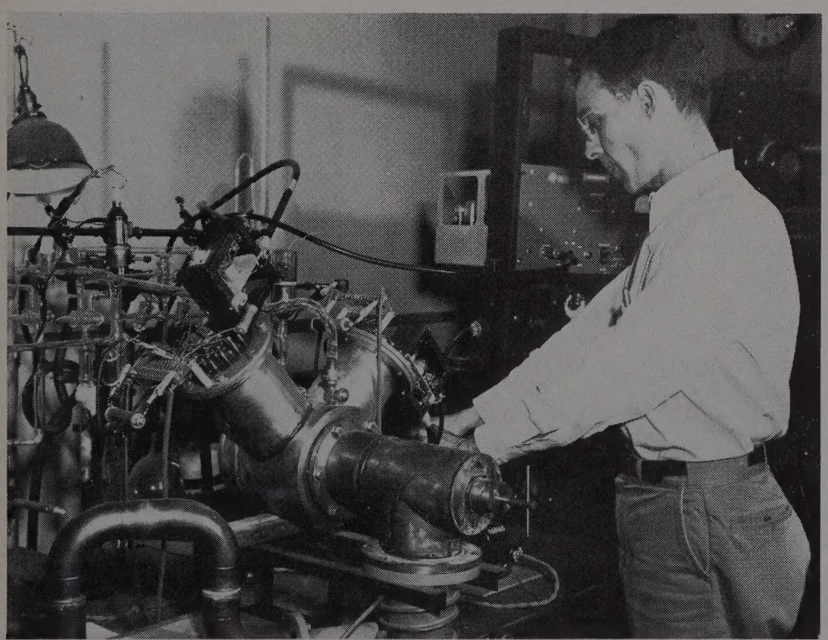
Other considerations caused them to give their hypothetical particle an angular momentum, or spin, of a half unit. A while later, physicists succeeded in measuring the angular momentum of the nucleus before and after the beta decay. They discovered that during the process it changed by one unit, and a half unit was carried off by the electron. The other half unit, then, had to be carried off by the neutrino in order to satisfy the conservation of angular momentum.

Mass of the Neutrino

There are several ways in which you can try to find the mass of the neutrino. All have shown only that the mass is very small, and give no reliable value for the mass *because* it is very small.

Take, for example, a method used by the British physicist, F. C. Frank. He used our old friend, beta decay. In beta decay, whatever energy is not car-

(*Continued on page 22*)



G. W. Rodeback, U. of Il physicist, looking at the heart of his and J. S. Allen's apparatus. Timing equipment is in the background.

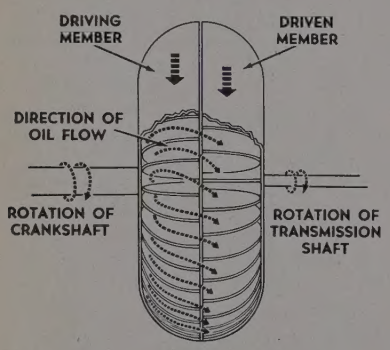
the case of . . .

the missing clutch

by Richard Choronzy, M.E. '51

The trend toward fluid transmissions in the automotive field this year could well mark the eventual disappearance of the clutch pedal and the gearshift lever in the commercial automobile of tomorrow. As a matter of fact, it is almost a rarity to find a 1951 model car which does not make available some type of fluid transmission, either standard or optional.

There are many points of difference of which the ordinary layman may not be aware. The disadvantages, not so apparent, are obscured by the greater ease and handling of the car it would seem, in every stage of its operation. On the other hand, the argument for fluid transmissions is justified because of the many improvements made during the war and postwar years. It is not to be denied that the fluid transmission



Typical fluid coupling operation. (Courtesy of Packard).

has made the conventional clutch obsolete. The situation might well be called the case of the vanishing clutch.

Let us analyze the case of the vanishing clutch. First of all, there are two types of fluid elements used and known as a fluid transmission. These are the fluid coupling and the hydraulic torque converter.

The Fluid Coupling

What is the fluid coupling? The basic principle is simple. The coupling or connecting element between two shafts is a fluid; there is no rigid mechanical connection between the two shafts. The principle can be illustrated by the use of two electric fans, with nothing but air between them, forming a fluid coupling. If the two fans are

RICHARD CHORONZY

Dick was instrumental in the organization of the Navy Pier branch of the TECH staff four years ago and was editor at "Harvard on the Rocks" before he came downstate.

Since then he has been assistant editor and later an associate editor of TECH. A senoir in mechanical engineering, Dick is also a member of ASME, the social fraternity, Sigma Phi Delta, and edited the I SEE program last year.

set close to one another, face to face, with one fan set in motion, the other will begin to rotate also. The fluid in this case is air, and it is this medium that transmits the power from one to the other.

A fluid coupling consists of a centrifugal pump and a turbine. Imagine a doughnut that is hollow and that has been cut in half, with radial blades fitted in the hollow opening. The first half, the pump impeller, is connected directly to the engine. The second half, called the turbine runner, and set very close to the impeller, is connected to the load (the force the power must act against). This unit is entirely surrounded by an oil-tight casing which is filled almost entirely with a light oil.

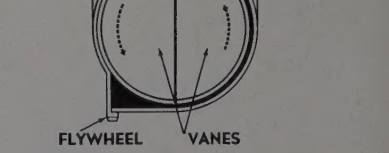
As the pump rotates, the oil is thrown centrifugally outward. The blades direct the oil across the short distance between pump and turbine, so that the oil is whirled against the vanes of the turbine runner with the correct magnitude and direction. In the standard fluid coupling there are no torque reacting elements other than the impeller and runner. Hence, the ratio of turning effort or torque never exceeds a one to one ratio.

Actually, the pump impeller always rotates at a faster speed than the turbine runner. The difference of speeds is the so-called *slip*. At the beginning of rotation, the slip is 100 per cent, until the inertia of the runner is overcome. At standard speeds and operating conditions, the slip has been known to be as little as 1 per cent. Standard fluid couplings in automobiles have a slip of about 5 per cent.

It should be noted here that slip is actually needed in order to run the coupling effectively. The oil runs down centriputally toward the center as a result of the difference of speed between impeller and runner. This is so because of the reduction of speed of oil as it hits the runner blades. The oil is then run back to the impeller where it is collected and thrown out again by centrifugal force.

There are numerous advantages that the fluid coupling has over the friction clutch, one of which is that no matter what the load, the engine will not stall; i.e., the load can be stalled completely without stalling the driving shaft. The engine can be accelerated before the automobile moves, thus permitting the automobile to start without stall, whereas the standard gear transmission would not permit this.

The advantage of eliminating sudden shocks or torsional vibrations is also



Cross section of typical fluid coupling showing crackshaft, driving and driven members, and transmission shaft. (Courtesy of Packard).

distinctive of the fluid coupling. The fluid serves to dampen all shocks and vibrations.

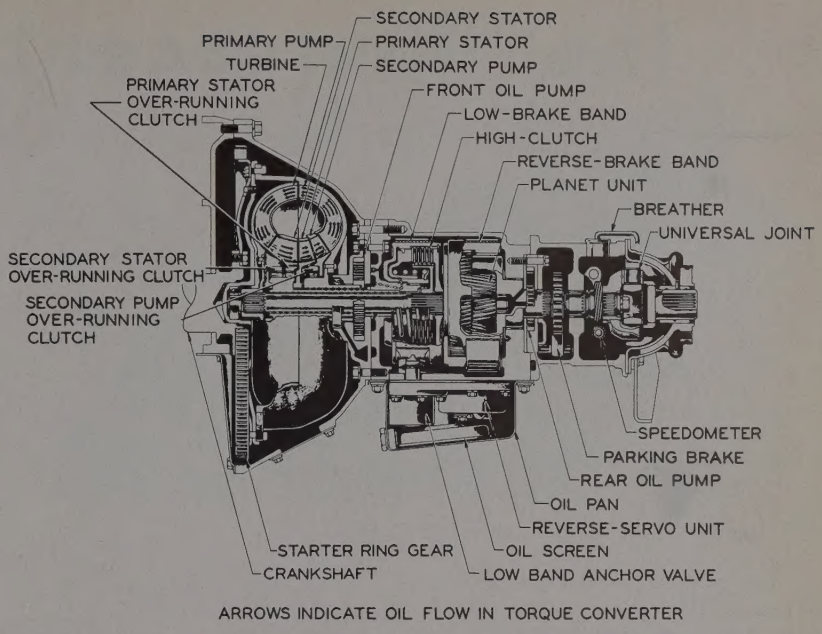
The Torque Converter

If a stationary or fixed guide vane is added in the circulatory circuit, there is a change in the torque and speed imparted to the runner. The fluid coupling then becomes a torque converter. There is a change in the direction of the oil due to the fixed guide vanes.

The torque converter thus, in effect, can act as a power gear. The torque is multiplied through the converter; today, ratios of about 2.1 to 1 are common in stock cars.

The torque converter is composed of three elements. In addition to the impeller and runner that is in the fluid coupling, there is the fixed guide wheel, known as the stator. The oil is thrown centrifugally against the blades of the runner as before in the fluid coupling. However, as the oil begins to run toward the center of the turbine (due to the slower speed, the oil does not stay at the periphery), it is forced through narrower passages, thus gaining more velocity. The oil is then directed through the stator element, which changes the direction so that the fluid can rotate in the same direction as the impeller. The fluid is then hurled back at the pump, in this way helping the pump to drive itself.

This, in effect, is the simple three element torque converter. There are many variations of this used in the automobiles of today. For instance, the Packard Ultramatic drive utilizes a second turbine runner (called secondary staging).



Cutaway view of the Buick Dynaflow transmission. (Courtesy of Buick Corporation).

With an increase in turbine speed, the direction of the oil changes until the oil begins to strike the back edges of the stator blades. The stator then begins to turn evenly with the turbine, and the amount of oil striking the vanes of the impeller with a multiplying force become less and less. Finally all three elements begin to turn with the same speed, and the torque converter becomes effectively a fluid coupling. This is desirable because of the higher efficiency and because a ratio of one to one comes into effect.

This action can be compared with that of the standard gears used in the old transmissions. The old gear box utilizing positive gears is also a torque converter. A clutch is used to disengage the gears however in the conversion of the gear ratios. The torque converter accomplishes the same thing smoothly with an infinite amount of ratios ranging from 2.5 to 1, to 1 to 1.

Hydraulic transmissions are generally supplemented with either a planetary gear system or synchromesh gear sets so that the car can be reversed or braked with the low gear.

Transmissions in Today's Cars

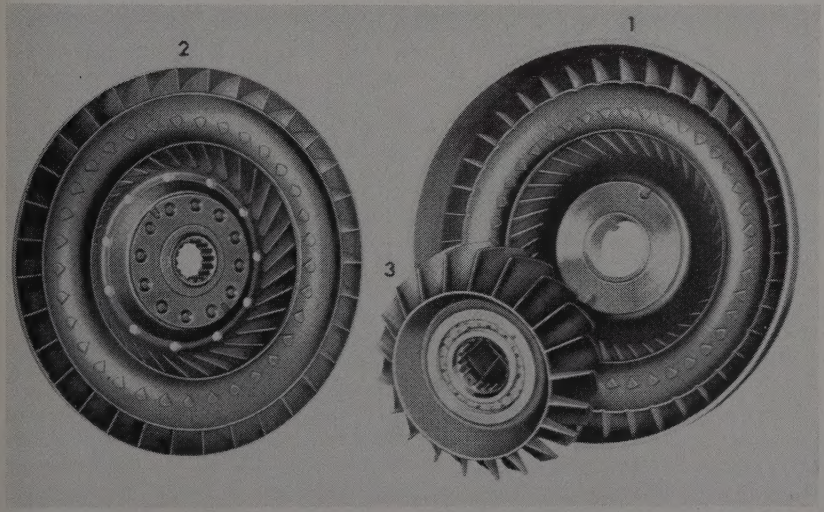
The fluid transmissions in commercial automobiles today are different in some respects, but basically they operate under the standard principles laid down for the simple fluid coupling and torque converter.

The Chrysler fluid drive is basically semi-automatic. A fluid coupling is used in conjunction with a synchromesh gear set, which provides four forward speeds and reverse.

There is a clutch on the floor-board, but it is seldom used for normal driving. There are two positions on the shift lever, high and low, in addition to reverse. In the high range, the top gear is reached merely by lifting your foot off the accelerator pedal momentarily.

The Hydra-Matic transmission is

(*Continued on page* 20)



Studebaker torque converter has essentially three major elements: (1) the impeller, connected to the engine crankshaft. (2) The turbine, attached to the converter output shaft. (3) The stator, connected to the transmission case through a free wheeling unit. (Courtesy of Studebaker).

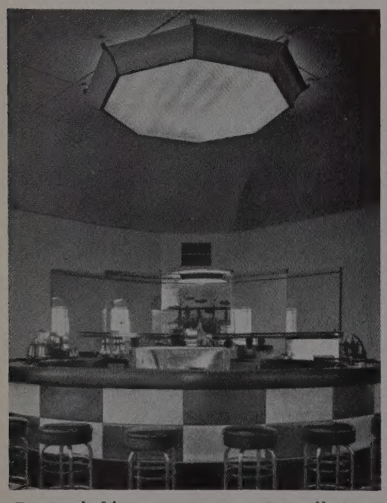
the fluorescent lamp

by Val McClusky, E.E. '51

(Concluded from February issue)

Now that considerable attention has been given to the construction of the lamp and to various features of auxiliary equipment, the functions of the components of the complete fluorescent lamp circuit may be better understood by considering the actual operations involved during the starting of a lamp placed in a typical circuit. The circuit shown in the diagram represents a typical single-lamp system employing a glow-switch starter and a ballast composed of a choke coil and a condenser in series. The switch-shunting capacitor has the function of filtering out harmonics which might cause undesirable radiation from the lamp.

Upon closing the line switch, the line potential is placed across the two contacts of the glow-switch starter. This voltage is sufficient to cause the gas within the starter to glow and become electrically conducting. As current flows through the starter, it also flows through the filaments, which are in series with the starter, causing them to heat and begin emitting electrons. The time required to heat the filaments is about 1 *sec.* (For the incandescent lamp, the time is about .0001 *sec*). During this time, heat from the glowing gas within the starter is causing the bimetallic strip to expand. When it has expanded to the point where it closes the contacts in the switch, the voltage causing the gas to glow is now shorted, and the gas stops glowing. The strip then begins cooling and contracting again. As it contracts, it breaks the connection across the switch contacts. When this occurs, due to the inductance of the choke coil in the ballast, a surge of voltage is placed across the filaments of the lamp. This causes the arc across the lamp to strike, and the lamp begins operating. The voltage that now exists across the starter contacts, which is equal in magnitude to the line voltage minus the voltage drop across the ballast, is insufficient to again produce a glow of the gas in the starter. Consequently, the starter remains inoperative and current flows through the lamp.



Typical fluorescent installation blends in with interior decorating. Radiant heat is eliminated.

Factors Affecting Operation

There are several factors which affect the performance of a fluorescent lamp, some of which will now be considered.

For satisfactory performance, a lamp voltage of about one-half the open-circuit line voltage is required. The rest of the drop occurs in the ballast. If a drop of less than one-half the line voltage exists across the lamp too much power loss occurs in the ballast. If the lamp voltage is greater than one-half the open-circuit line voltage, the drop across the ballast is insufficient to limit preheating currents to safe values, and the cathode undergoes excessive heating.

It has been found that highest light output is obtained when the bulb temperature is between 100° and 120° *F.* This condition is obtained when the ambient temperature of the air around the lamp is between 70° and 80° *F.*

An additional factor in the performance of a fluorescent lamp, one which affects the life of the tube, is the frequency with which the lamp is started. A lamp will give more hours of service when the burning periods are longer for each start and the number of starts are decreased.

The number of hours of use of a fluorescent lamp is another factor which affects the performance with respect to light output. Light output decreases rapidly during the first 100 hours of use. The loss in light output during this period may be as great as 10%. For this reason, tests to determine light output begin with lamps that have been in use for at least 100 hours. During the life of the lamp, the light output averages about 80% of the value obtained for 100 hours of use.

Comparison of the Fluorescent and Incandescent Lamps

In some ways, the fluorescent lamp has decided advantages over the incandescent lamp.

For one thing, it is more efficient and therefore, more economical to use. For a 40-watt white fluorescent lamp, 8.7 watts of power are required to produce 1,000 lumens of light, whereas 43 watts are required to produce the same amount of light from a 200-watt General Service incandescent lamp.

Another advantage of the fluorescent, one which the reader has possibly had occasion to observe, is the fact that the annoyance due to radiant heat from this lamp is not nearly so noticeable as it is for the incandescent lamp. In fact, the degree to which this radiant heat is noticed by the observer is about five times as great for the incandescent lamp.

Despite the fact that in some ways the fluorescent lamp surpasses the incandescent in presenting a satisfactory light source to the consumer, one must still recognize the fact that it is far from perfect. There are certain disadvantages which might, in many applications, make this type of light source limited, if not excluded, for use.

One of these, a characteristic of all gaseous discharge lamps, is the stroboscopic effect obtained when the lamp is operated on *AC*. Since, on *AC* operation, the current goes to zero twice during each cycle, the discharge is actually inconstant. This flicker is partially compensated by the slight phosphorescent property of the powders used to form the fluorescent coating. All of the powders, except blue, possess this property.

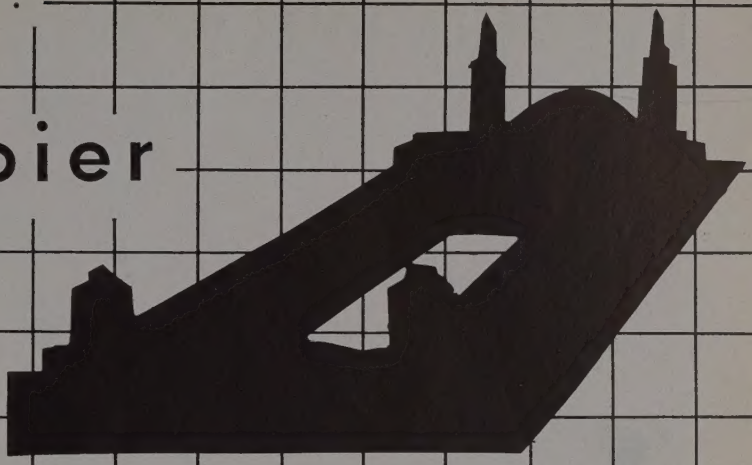
The light output from a lamp containing an incandescent filament is definitely more constant. This, of course, is to be expected, since the filament temperature cannot change as suddenly as the magnitude of the current flowing through it.

Another unpleasant feature of the fluorescent lamp, a characteristic of any gaseous discharge tube, is the fact that radiations from the discharging arc very

(Continued on page 26)

— the university of illinois at . . .

navy pier



by Ray Lindahl, Arch.E. '54

Harvard on the Rocks

Three-score and seven years ago our fathers brought forth on the shores of Lake Michigan, a new structure, conceived in the minds of engineers and dedicated to the proposition that it would bring joy to the lives of many people.

Now we are suffering on that Pier, testing the ability of the engineer, even though it is no longer bearing the proposition of its original dedication. The task remaining for us is to rededicate this hallowed ground upon which we tread, to the job of producing men and women believing in a government of the people, by the people and for the people which will not perish from the earth.

Farewell, G.I.'s

It is a little late to say farewell to many G.I.'s for we will miss you sadly. We will miss the excuses you gave your wives the morning after the night before. We'll always remember them, especially, "but really honey, that was no lipstick on my lapel, it was just some cherry pie."

I am just repeating what I heard, but they say that President Stoddard really said this. He sees no reason why college graduates could not end up in an intellectual profession like bricklaying. The bricklayers completely disagree with him. They claim that there is enough trouble without starting squabbles because you went to the wrong school or belonged to the wrong fraternity.

If you men think you are having trouble with the women, we have found a solution. There is a course for men in the Atlanta (Ga) Academy of Charm. There you can take courses in techniques for attracting women and keeping a woman wondering. Of course, there are some archies and engineers who have no need for these courses judging from their actions in the front lounge.

But beware, accurate polls show that more girls are paying for the marriage licenses and even some are buying one and then going off to find their hero and marry him before he knows what has happened to him. This marriage problem is tricky especially since spring is coming. We have a further word of warning, the death rate from homicide is much higher among single people than among the married, believe it or not.

If there are any intellectual geniuses among our avid readers, who feels they also have no sense and would like to contribute to this column, either literarily or financially, please send or bring them to the editor in Room 150-B. We now humbly close with these final words of wisdom, "Join now, avoid the June rush."

engineering societies

AIEE-IRE

With a fine showing of members at their first meeting of the semester on February 20, the AIEE-IRE held their election of officers. Those elected were: Charles Kersch, chairman; Tom Madden, vice-chairman; Vito Minerva, secretary; Herb Hornischer, treasurer; and Frances Watkins, Engineering Council representative.

The student chapter had a very busy but inteersting time on March 1. In the afternoon they had a field trip to the R. R. Donnelly Co. The tour consisted of inspection of the plant's electrically controlled equipment necessary in the production of large scale printed matter.

Later in the day the Western Society of Engineers was host for an entertaining social hour. Then for a fitting close of a busy day, they attended a student engineer's night presented by the Chicago section of AIEE. After a delicious dinner, Mr. Titus LeClaire, national president of AIEE and chief electrical engineer of Commonwealth Edison Co. presented a timely speech entitled, "Are You An Engineer?"

AIA

At the first meeting of the semester, on February 20, the following men were elected as officers of the AIA: Gus Kostopulos, vice-president; John Pawlikowski, treasurer; and Ray Shlaustas, historian. They will assist the officers from last semester, Ross Parkerson, president, and Joyce Davis, secretary.

The committee chairmen were also elected and have since organized their committees. The social committee is headed by John White who will be assisted by Don Rutkowski, Gus Kostopulos and Ray Shlaustas.

The chairman of the membership committee is Joe Kourakis, who is assisted by the following archies: Ted Larson, Don Schreiber, and Nick Ellis. The public relations committee is directed by Ray Lindahl who is helped by Bob Sanford.

Plans have been made for a dance to be held on March 26. The place has not yet been determined but special in-

(*Continued on page* 28)

introducing . . .

by Henry Spies, Ag.E. '52

JAMES A. GARMAN

His flaming hair crew-cut and his amiable smile have made Jim Garman a familiar figure to both agricultural and mechanical engineering groups here on campus. Ambitious for more than one degree, Jim will graduate in June of 1952 with two, one in mechanical engineering and one in agricultural engineering.

Asked why he had planned such a

JAMES A. GARMAN

program, Jim explained that he had been reared on a farm and " . . . I didn't care much for the animals, but I did like the machinery. . . ." He first decided that he wanted to go into mechanical engineering in his third year in high school.

Born on November 11, 1927, Jim claims he grew up "more or less" in Bethany, Ill. He graduated from Bethany Township high school in June, 1945. Before coming to Illinois in the fall of 1947, Jim worked to gain practical farm experience and to gather enough money to cover some of his college expenses.

The American Foundrymen's Society has been one of Jim's dominant interests, and he has served as its president for 1950. Phi Eta Sigma in his freshman year and Pi Tau Sigma have brought him scholastic honors. He is also a member of the professional societies, ASME, MIS, and ASAE. McKinley Foundation is another of his activities. At the time of his graduation next year, Jim will go into aviation cadet training for officers. At the present time he is in the reserve in Air Force maintenance.

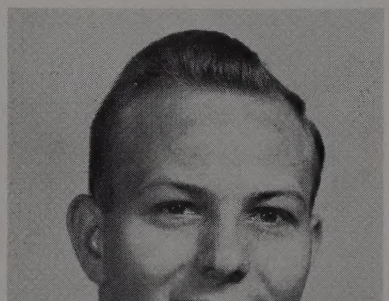
If it were peacetime Jim would like to go ahead for his master's degree in agricultural engineering after graduation. He feels that specialization in grain harvesting equipment would be his field since the development of grain drying is relatively new.

Jim is a member of the University Rifle team and is among the first five highest men in marksmanship. He has hobbies of photography and has his own woodworking shop here on campus. He is also a member of Sigma Phi Delta and was recently appointed their assistant chaplain.

RON HOEFLE

One of the outstanding June graduates of the College of Engineering will be Ron Hoefle, construction option, department of civil engineering.

Ron is a native of Freeport, Ill., and was born there April 24, 1929. He attended grade and high schools in Free-



RON HOEFLE

port. His main activities in high school were the Photographic and Conservation clubs.

Entering the University of Illinois in September, 1947, he began amassing honors by becoming a member of Phi Eta Sigma, freshman honorary. In his sophomore year he was initiated into Alpha Phi Omega, Boy Scout service fraternity. Since that time, he has become a meber of Tau Beta Pi and Sigma Tau, all-engineering honoraries, and Chi Epsilon, the civil engineering honorary, of which he is now president. During his spare time he is an active member of ASCE, and was president of that organization last semester. Ron was also chairman of the physical arrangements committee of St. Pat's ball in 1950 and 1951. At present he is enrolled in advanced corps, AROTC. During the last two summer vacations, he has been employed by the Bureau of Reclamation on an irrigation project in Nebraska.

Ron's graduation plans at present are being arranged by Uncle Sam, but we sincerely hope that the field of construction engineering will not be deprived of the services of a man of his caliber for an extended period of time.

---

safer glass for autos

As a result of constant research by glass manufacturers, the visibility and shatter-proof qualities of safety glass used in windshields are higher than ever. Rigid test requirements have been raised accordingly.

Buyers of new cars may have noticed the symbols "ASI" etched in a corner of their windshields. Owners of older models, back to 1938, would find a slightly different inscription, "AS-WS".

Both mean that the safety glass in the windshield meets American Standard specifications and tests. "AS-WS" stood for "American Standard Windshield." New, more complicated symbols have been adopted. The letters "AS" now are followed by numbers, indicating that materials used qualify for a particular position in the vehicle. Thus, the number "one" denotes glass approved for windshields.

The 1938 edition of the American Standard included nine major tests for windshield glass such as exposure to sunlight, humidity, boiling, impact ($\frac{1}{2}$-*lb* steel ball dropped from 10 *ft*, fracture pattern, minimum strength on impact of large object (11 lb shot bag), impact of small, hard object (7 *oz* dart), over-all strength (steel ball dropped 16 *ft*, and visibility distortion.

Newly revised standards recognize the improvements made in safety glass, and test requirements have been raised.

The ME instructor placed the chisel against the rusty bolt. He looked at the ME student and said, "When I nod my head, you hit it."

They're burying him tomorrow at noon.

"Mr. Bell, I heard every word you said — distinctly!"

75 YEARS OF TELEPHONE SERVICE

On the evening of March 10, 1876, on the top floor of a boarding house in Boston, the telephone carried its first intelligible sentence.

It seemed like a miracle to our grandparents and great-grandparents. Yet today, the telephone is a part of our everyday living. And that is the real miracle — the fact that the telephone has come to mean so much to so many people in so many ways.

The telephone is an indispensable tool of business and government — today's tremendous job of production and defense could not be carried on without it. It serves in minor emergencies and great ones. It helps maintain family and community ties. And it keeps right on growing and improving.

Never in the history of the telephone has it been so valuable to so many people as right now.

BELL TELEPHONE SYSTEM

one of the largest

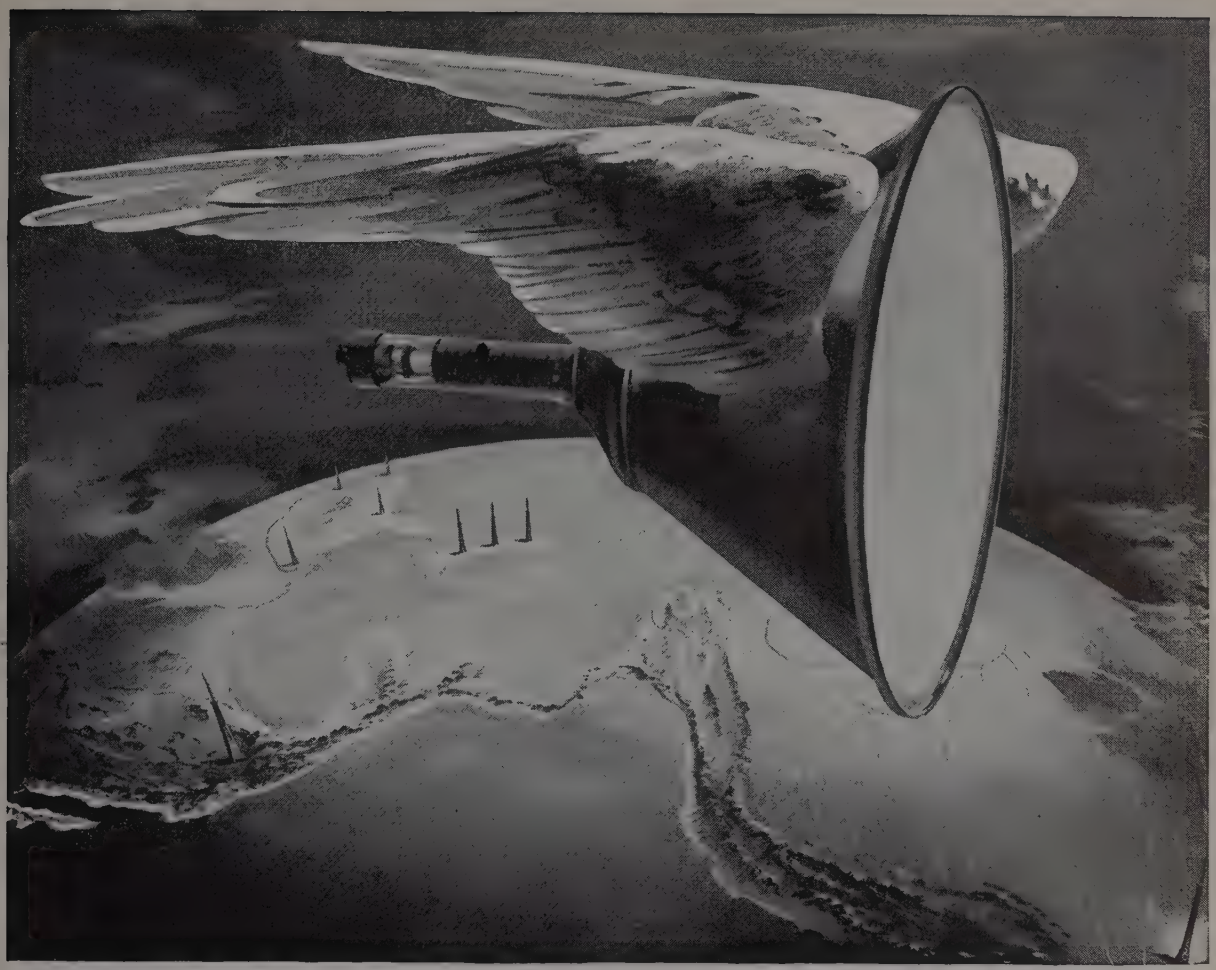
. . . engineering campuses in the world is ours and what evidence does a visitor see of it except bigger and newer buildings? We certainly can't point with pride at our transportation facilities. What is more ridiculous than modern buildings set in a system of semi-paved cowpaths?

Of all the so-called streets on campus the only one that approaches adequate capacity is Wright and even it gets a bit congested between classes. Probably the worst excuse for a thoroughfare, outside of the one-way streets, is Mathews. With parking on both sides it narrows to a width of two buggies and a bicycle.

Another antiquated feature present here is the complete lack of adequate parking space. It would seem a more positive approach to this problem to provide more parking areas instead of the present method of curtailing auto permits.

The obvious solution to these problems would be to build adequate parking lots, widen and resurface the streets, and construct a complete network of bicycle walks to keep them off the streets and sidewalks. Just the provision of adequate parking spaces off the streets would help to alleviate the problem of narrow streets and resulting congestion. The parking lots could be financed at least in part by students paying a nominal semester parking fee.

Of course, the seemingly logical way to finance these necessary changes for the students of the PRESENT would be to use some of the millions being spent on buildings for the dubious number of students of the FUTURE.—J.R.H.



Five new RCA-equipped stations in Mexico, Brazil, and Cuba, add television to the forces which make Good Neighbors of all the Americas.

Now television goes "Good Neighbor"

As little as 10 short years ago, television—to the average man on the street—seemed far away. Today, television is in 10,500,000 homes.

Newest demonstration of TV's growth is its leap to Latin America. 3 RCA-equipped stations are now in Cuba, 1 in Mexico, another in Brazil—and more are planned. They are contributing to television progress by following a single telecasting standard. They also use developments from RCA Laboratories: the image orthicon television camera, electron tubes, monitoring equipment, and antennas.

And as our neighbors to the south watch television at home, they see another development of RCA research—the kinescope. The face of this tube is the "screen" in all-electronic home TV receivers . . . on which one sees sharp, clear pictures in motion.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, New York.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.
Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

honorary and society news

by Chuck Wade, M.E. '52

SAE

At the first meeting of the new semester, the newly elected officers of the SAE, as follows, presided: William McNulty, chairman; Victor Swenson, vice-chairman; Orville Rinne, treasurer; Walter Kocolovski, corresponding secretary; Ernest N. Pearson, recording secretary; Miller, junior engineering council representative; and Bud Brux, senior Engineering Council representative.

The meeting was held on February 21 in 319 Civil Engineering hall, and the speaker was Mr. R. J. Greenshield, director of research of Shell Research laboratory at Wood River, Ill. His speech topic was "150 Miles Per Gallon Is Possible." Slides were shown of the results of the annual gas mileage marathon held at the Wood River laboratory as well as slides of some of the autos taking part in the contest. At the conclusion of his talk, Mr. Greenshield distributed copies of his paper. The program chairman is Jim Marich, and the advertising chairman is Don Cain.

On March 12, the student branches of the SAE of the University of Bradley and the University of Illinois participated in a debate on the subject of rear engine location in automobiles as opposed to the front engine location. The U. of I. chose to speak on the affirmative side at this debate held at Peoria. The Illinois team was George Franzen, Charles Pipenhagen, Donald Cain, and Ernest N. Pearson.

ASCE

A meeting of the executive council was held February 20 for the purpose of planning the meetings for the spring semester. At the March meeting, H. E. Hudson, head of the engineering subdivision, State Water Supply, spoke on Illinois state water resources. The April meeting will be under the direction of the architectural engineers, who will arrange for the speaker.

The convention of the Midwest Conference of ASCE will be held April 13 and 14 in Milwaukee, under the auspices of Marquette university. On April 13 a banquet will be given at the Allis-Chalmers club house. A gathering at the Blatz auditorium, and a discussion with prominent Milwaukee men will follow. On April 14 the speaker will be Dr. A. Allan Bates, vice-president of the PCA, on "The Role of Engineers in National Affairs." A field trip will be made to the Miller Brewery, Milwaukee's future Municipal stadium, and a trip through filtration plants. There will be a dance and stag party in the evening. Any C.E.'s interested should contact one of the officers.

PI TAU SIGMA

Alpha chapter of Pi Tau Sigma held an initiation banquet in the University of Illinois YMCA on December 20, 1950. The following men were initiated: D. R. Bahnfleth, W. H. Beck, T. R. Berg, F. H. Bermier, Jr., A. F. Brux, W. C. Eberhardt, G. J. Fehlaber, E. F. Fort, W. D. Hansen, C. R. Hudson, O. Kozeny, Jr., R. L. Lessin, R. L. McMahon, N. G. Ohlson, R. H. Page, G. Riske, D. D. Strohbeck, C. H. Wade, M. Yamamoto, and P. H. Zachan. After the banquet, the following officers were elected for the spring semester: Peter C. Kostoff, president; James L. Little, vice-president; Patrick C. Fahey, treasurer; James T. Marsden, secretary; Wallace C. Eberhardt, recording secretary. It has been announced that there will be pledging and a banquet during the spring semester.

AIEE-IRE

The "on campus" field trip held on February 21 was quite successful; about 80 tickets were sold. Places visited were the Physics Research lab (betatron), Abbott power plant, and the vacuum tube lab and digital computer in the EE research lab. The first stationary meeting of the semester was to be held on March 1; Cyril N. Hoyler of RCA laboratories was to be the speaker. Unfortunately, Mr. Hoyler was involved in an accident the day of the meeting, was temporarily hospitalized, and had to return home; the meeting was cancelled.

A series of nine lectures, called "A Survey of Electronic Ordnance," will be sponsored this semester by the society. These lectures will be held about once every two weeks; faculty members of the EE department will speak.

Dr. William L. Everitt gave the opening talk, "Men As a Part of Electronic Equipment." The lecture was given twice, the evening of March 5 and the afternoon of March 8, to accommodate the large number of interested students. This practice probably will be followed in future sessions.

TRIANGLE

To get the new semester off to a good start, the pledge class of Triangle gave the active chapter a dance called the "Corn Cob Capers" on February 24. The chaperones for this gala affair were Professor and Mrs. L. D. Walker, Professor and Mrs. Walter Hanson, and Mr. and Mrs. Richard Elstner.

Already placing a guiding hand on the affairs of the fraternity are its new officers: Don Jones, president; Bob Enroth, vice-president; Norm Smith, secretary; Gene Groff, treasurer; and Gerald Griffen, corresponding secretary.

Showing their scholastic prowess, the pledge class was first in all-pledge scholarship and the fraternity as a whole ranked fourth in all-fraternity scholarship.

IAS

The following officers for the spring semester were elected: Corliss Laisure, chairman; James Watson, vice-chairman; Elmer Schirmer, secretary-treasurer; Robert Johnson, Engineering Council.

ASAE

A regularly scheduled meeting of the ASAE was held February 20, in 201 Agricultural Engineering building at 7:15 p. m. The newly elected officers for the spring semester were in charge. It was decided to change the schedule of meetings to the second and fourth Tuesdays of the month, at

(*Continued on page* 28)

Build Confidence ON BROAD EXPERIENCE

by ARCH COOPER
Manager, Empire Region
ALLIS-CHALMERS MANUFACTURING COMPANY
(*Graduate Training Course—1909*)

YOU NEED the confidence that comes from wide experience, whether you intend to be a salesman, designer, researcher, or production man. Confidence based on knowledge is one of the greatest assets an engineer can have. Here is what I mean.

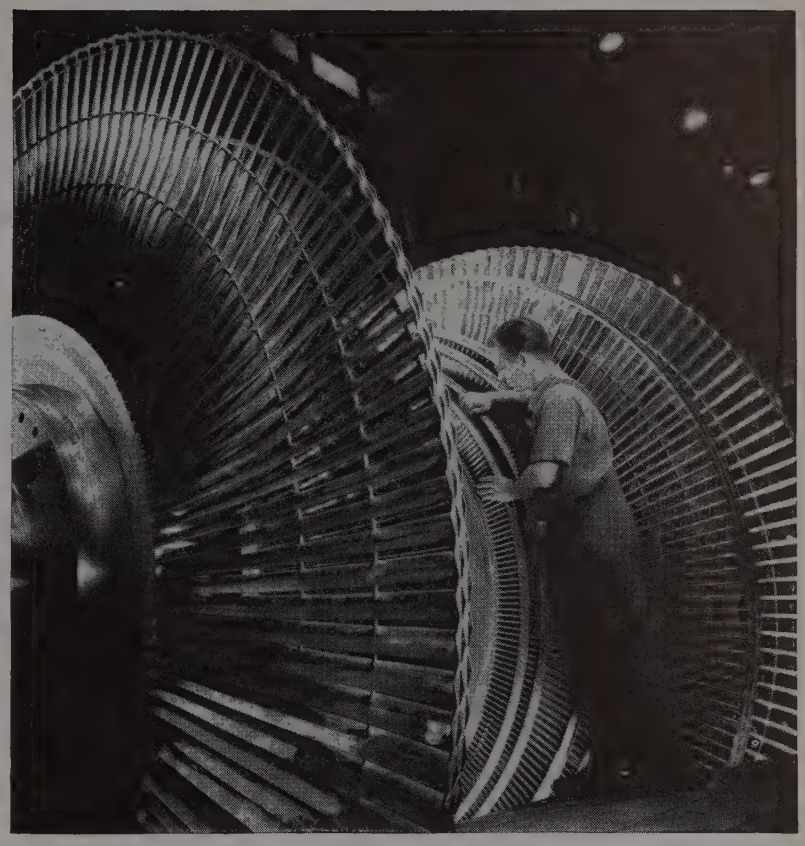
ARCH COOPER

You may visit a mine with the idea of talking about crushing equipment, but find that their engineers have an electrical problem. Or you may visit a utility to talk about electrical equipment and find that they're all excited about a pump break-down.

Offer All-Around Help

Can you help them? Or are you just another peddler who is taking their time when they have problems on their minds. In my work I call on electric utilities, cement plants, machinery builders, textile mills, paper mills, shoe factories and many other types of plants. In each of them, I try to help the engineers and mechanics I call on.

It's a good credo for salesmen, but it takes broad experience to carry it out. It's the kind of experience you must deliberately set about acquiring as early as possible. I had heard of Allis-Chalmers equipment, seen A-C's giant Corliss engines in Australia's biggest power plant and decided to study design at Allis-Chalmers. It looked like the best place in the world to get a broad engineering background.



High temperatures and speeds raise tough design and production problems on giant steam turbine spindles like these.

I joined the Allis-Chalmers Graduate Training Course after graduation from Sydney Technical College in 1908 . . . worked on steam turbines, wound coils of all types, performed tests for the electrical department. After that there were field trips to erect electrical equipment. It was soon apparent that I wasn't a designer at heart, and my sales career started.

Broad Opportunity

Forty-one years later, Allis-Chalmers still offers the same opportunity for broad experience. A-C still builds equipment for electric power, mining and ore reduction, cement making, public works, pulp and wood processing, and flour milling.

And the Allis-Chalmers Graduate Training Course is still flexible. Students help plan their own courses. They can switch to design, manufacturing, research, application, sales, or advertising—divide their time between shops and offices—and can earn advanced degrees in engineering at the same time.

Men at Allis-Chalmers get a close-up of the basic industries. No matter what path they take in the industrial world, experience gained with this broad organization lays a foundation for the confidence that comes with all-around knowledge.

Textile mills are getting adjustable speed at lower cost by using new automatic Vari-Pitch sheaves on spinning frames as shown.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

by Bob Schrader, M.E. '54

There is a senior civil engineer in the hydraulics option by the name of Walt Tudor. This, in itself, is not a profound statement. The important fact is that the man is one of the world's greatest geniuses.

In an earth and masonry dams course, the instructor was naming the various classes of masonry dams. "He forgot to mention beaver dams," Mr. Tudor observed.

A fellow C.E. cringed and commented, "Well, why didn't you call it to his attention?"

Then came the quiet reply, "He doesn't look like the eager beaver type."

* * *

FLUSH YE BONEYARD

* * *

A big event for the chemical engineering department will be the dedication of the new East Chemistry building on March 30 and 31. All the alumni of the Ch.E. school at Illinois have been invited to the dedication of the $3,400,000 building. There will be eight speakers on the program, four chem engineers and four biochemists, all U. of I. graduates. The program will also include several social functions and a formal dedication ceremony, as well as inspection tours of the East Chem building.

* * *

FLUSH YE BONEYARD

* * *

A freshman engineer had a summer job at a shipyard. The first morning the foreman sent him out with a two-foot ruler to measure a steel plate. Half an hour later, the young engineer returned with a satisfied grin.

"Well, what's the size?" the foreman wearily asked.

Came the proud reply: "It's the length of the ruler and two thumbs over and the length of my arm from here to here, minus the fingernails."

Another one of the projects which the Engineering Council participated in this year was the second annual career conference. Ed Christiansen and Wayne Hartman represented the council on the Career Conference central committee. An exceptional group of speakers was scheduled for this year. Among those who spoke were: R. E. Peterson, Westinghouse, to the mechanical engineers; Charles Pearce of the American Ceramic Society, who spoke to ceramic engineers; J. F. Zimmerman, Sinclair Oil Co., on the automotive field of mechanical engineering; Walter C. Hall, Illinois Bell Telephone, concerning communications for electrical engineers; L. J. Fletcher, of Caterpillar Co., to the agricultural engineers; Robert L. York, Monsanto Chemical, on chemical engineering; R. N. Bergendoff of Howard, Needles, Tammen and Bergendoff, to the civil engineers; W. L. Seelback, Superior Foundry, on the subject of opportunities in foundry work; R. J. Diefenthaler, General Electric, to illumination engineers; and Joseph Boyce, Argonne National Laboratory, on general engineering.

* * *

FLUSH YE BONEYARD

* * *

An old Indian couple who had never been off the reservation before, decided to have a fling and take a vacation and stay at a white man's hotel.

Their first night there, the old brave awoke and growled, "Ugh, me heap thirsty—go get water." The squaw obediently padded down the hotel corridor and disappeared; soon she came back with a little envelope of water. Satisfied, he returned to sleep but woke up later and made the same request again. The squaw uncomplainingly got up and went down the corridor again.

After a long time she returned empty-handed. The brave scowled at her, "Ugh, why no water?"

"Ugh, heap big white chief sitting on well."

The *Technograph* was host to thei Navy Pier staff for a weekend in Feb ruary. The Navy Pier boys had bee planning a trip down to the Champaign Urbana campus since late fall. Ray Lin dahl, Navy Pier editor; Gene Anderson business manager; Warren Brandt, an Peter Cattapan made the trip. The drove down on a Saturday morning an spent most of Saturday seeing the cam pus. The boys spent the night at Sigm Phi Delta and Triangle, the two socia engineering fraternities here on campus

* * *

FLUSH YE BONEYARD

* * *

The unbelievable has happened Brother Engineers. The Boneyard i getting cleaner. Yes, the beloved broo is on its way to becoming a clear littl stream. At least, it is making a smal step in that direction. According t Frank Anderson, assistant engineer o the Urbana-Champaign sanitary district the BOD of the Boneyard has droppe from 14 parts per million to 3 part per million. This drop in pollution wa due mainly to the mending of a broke 6-inch sewer which flowed into th Boneyard. How does the saying go "Good riddance to . . . ?

* * *

FLUSH YE BONEYARD

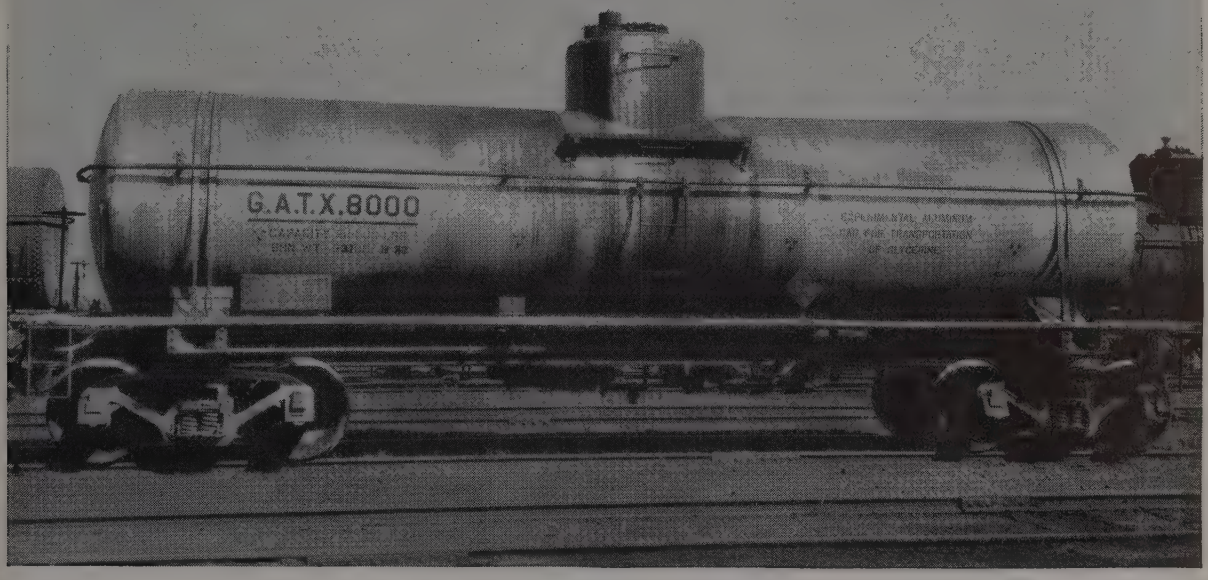
* * *

A pretty girl appeared at a party wearing a tiny silver airplane on a chai around her neck. It was a cute orna ment and she was not only proud of it but quite conscious of it. She found he dinner partner eyeing her in the direc tion of the silver trinket and so sh asked him proudly, by way of startin small talk: "Do you like my little air plane?"

"Yes," replied the young gallant by her side, "but I was mostly admirin the landing field."

THEY MADE HISTORY!

This car, and the men who designed it



Back in 1928 Alcoa engineers pointed out the advantages that aluminum would bring to railroad tank cars carrying hard to hold chemicals; easily contaminated foods. So Alcoa designed and undertook to pay for the first aluminum tank car. The car builder and a shipper became interested. On completion of the car, the builder assumed the cost and leased it to the shipper for regular service.

Interest in aluminum tank cars increased. Impact recorders and strain gauges gave the designers new data. The aluminum production men rolled the heaviest plate; made the largest rivets produced up to that time. The second car was made from 8 instead of 16 plates. Joining time cut in half!

Today three plates, plus heads, joined by newly developed welding methods make an aluminum tank car. And 1,300 of them, including the first one ever made, are in service. Another instance where Alcoa engineering and co-operation have brought the advantages of aluminum to a new application. Throughout the Alcoa organization, in research, production and sales, similar pioneering jobs are in progress now and others are waiting for the men with the imagineering ability to tackle them.

ALUMINUM COMPANY OF AMERICA, 742 Gulf Building, Pittsburgh 19, Pennsylvania.

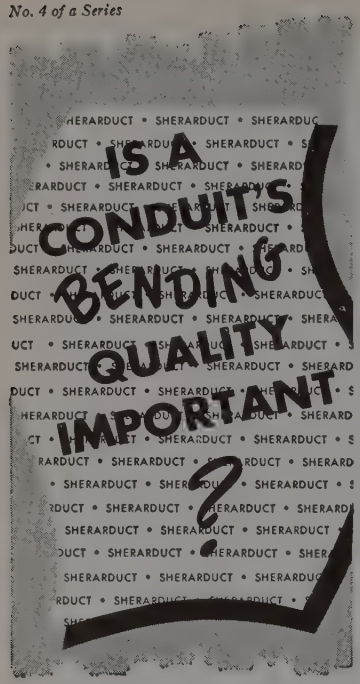
A business built on co-operation

ALCOA®

ALCOA

ALUMINUM COMPANY OF AMERICA

No. 4 of a Series



You bet it is! An electrical conduit has to bend easily, yet not collapse, flake, chip or crack. And when it's bent it must retain the full bend. That's why Sherarduct is so widely used throughout the electrical industry. It meets *all* of these requirements and more.

Sherarduct is made of mild, high-grade steel that is Spellerized to assure a fine, even-textured conduit. Because of its malleability and ductility, it is easily bent, with no spring back. When Sherarduct is bent to 90° it *stays* at 90°!

Sherarduct is speedily installed, permits symmetrical conduit runs and banks. It prevents costly hold ups on the job, labor kick backs, erratic flow of materials. When you use Sherarduct, the whole conduit installation goes up faster, easier, more economically.

EVERYTHING IN WIRING POINTS TO

National Electric
PRODUCTS CORPORATION
PITTSBURGH, PA.

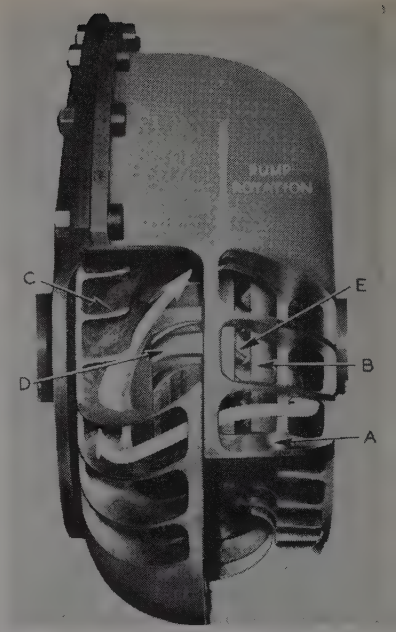
MISSING CLUTCH . . .

(*Continued from page* 9)

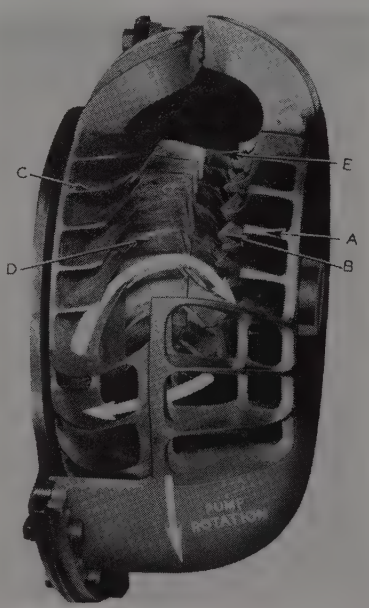
complex but also, a very efficient and refined mechanism. The Hydra-Matic transmission consists of a fluid coupling and three planetary units placed in series. Here, no gear-shift lever or clutch pedal is employed at all. The transmission automatically shifts through four different speeds through a complicated series of engagements, both mechanical and fluid. An advantage in this transmission is the reduction in the rear axle ratio. The engine runs slower when in fourth speed, thereby giving better fuel economy, longer engine life, and less noise and vibration.

The Buick Dynaflow drive is composed of two pump sections, one turbine runner, and a primary and secondary stator. A planetary gear set is provided merely for secondary uses. All normal driving is accomplished through fluid transmission. Dynaflow is probably the most simple transmission on the market, and one of the most economical over the long run.

The Powerglide, Chevrolet transmission, is practically the same as that of



Oil flow in torque converter during steady, level driving. (Courtesy of Buick Corporation).



Oil flow in Buick Dynaflow torque converter during acceleration. (Courtesy of Buick Corporation).

Buick, except that the former uses small reverse pump and turbine elements for downhill braking.

The Packard Ultramatic transmission is fully automatic, and as stated previously, utilizes a primary turbine, a reactor, a secondary turbine, and a pump. The Ultramatic incorporates a planetary gear set for emergency low and reverse gear operation. Otherwise, the transmission is entirely fluid throughout.

Studebaker's automatic drive is also a fully automatic torque converter. However, there is not an infinite number of ratios as in the Ultramatic and Dynaflow. In fact, at high speed, the transmission automatically locks into direct mechanical drive. The Studebaker transmission is economical, especially at high speeds.

The new Ford transmission, like the Studebaker transmission, was designed by Borg-Warner, and employs the use of the three element converter along with an automatic planetary transmission. However, this whole drive is fluid.

These are the transmissions that are in the automobiles of 1951. It is almost a certainty that within ten years, the clutch pedal will have vanished from the floor-board.

When the white man discovered this country, the Indians were running it. There were no taxes. There were no debts. The women did all the work. The white man thought he could improve on a system like that!

* * *

ME: "How did you get your tongue so black?"

CE: "I dropped my bottle on a freshly tarred road."

* * *

"Why are you wearing that toothbrush in your lapel?"

"That's my school pin; I went to Colgate."

THE DU PONT DIGEST

With silica, water and imagination
Du Pont scientists have found

How to Tame Slippery Floors

Teen-agers in high schools used to have great, if hazardous, fun running and sliding on newly waxed corridor floors. Of late many of them haven't been able to do that. For numerous schools, as well as office buildings and institutions, are now using waxes that have been made skid-resistant.

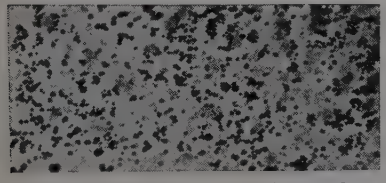
The product that is taming slippery floors is "Ludox" colloidal silica —adapted by Du Pont chemists to floor wax through cooperative research with the wax industry.

If you mix plain sand with floor wax, you'll have an anti-slip surface, but it would be unsightly and thoroughly impractical. With "Ludox," you are using a water suspension of invisible colloidal silica particles less than a millionth of an inch in diameter.

A problem child

"Ludox" was quite a problem child to scientists who developed it. For instance, research men had to know how silica would act in the presence of floor wax. So they turned to the electron microscope and learned that the little silica spheres attach themselves firmly to the surfaces of wax spheres five times their size.

But it was also necessary to find out how "Ludox" affects a waxy film after it is laid down on a floor. While a polished waxed floor looks smooth enough, it is actually a series of hills and valleys and these irregularities have an important bearing on the behavior of a surface.



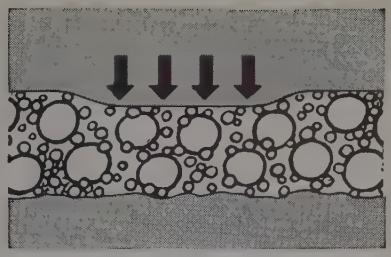
"Ludox" particles (*dark, in this electron photomicrograph*) *surround the larger wax particles throughout depth of film.* Magnified 25,000 x.

Du Pont "Ludox" *makes floor waxes harder as well as safer. Other wax qualities—gloss, freeze- and water-resistance, leveling—are unaffected. It is now used by many manufacturers.*

Working with a waxed surface presented difficulties. The electron microscope functions only if electron beams can pass through the membrane upon which the specimen is placed. And electrons can't "see through" a floor!

Study in duplication

Often, problems like this have been solved by preparing a thin replica or copy of the surface for examination in its stead. However, the conventional method for making a replica—the one frequently used in studying metals—requires solvents. These would dissolve and ruin a wax surface.



Cross-section *of wax film shows how pressure of foot pushes the hard "Ludox" particles into the wax, causing a snubbing action.*

So it became necessary for the chemists and electron microscopists to develop an entirely new way to make a replica of a surface. This they did, as part of a research program that lasted several years.

With it some remarkable pictures were made. They showed that many "Ludox" particles stay at the surface of a wax film, even though they are denser than wax. As you walk on a floor, your shoe presses the tiny silica particles down into the wax spheres that make up the film. This sets up a snubbing action which keeps you from slipping.

Much more could be told about Du Pont research on colloidal silica. For example, chemical and mechanical engineers had to develop manufacturing equipment, including a specially designed ion exchange column. Organic and physical chemists used research findings to formulate better waxes, as well as silica-containing adhesives and anti-slip treatments for rayon fabrics. Like practically all Du Pont achievements, "Ludox" is the result of close, continuous teamwork of men and women trained in many fields of science.

DID YOU KNOW . . .

it costs more than $10,000 on the average to provide the tools, machines, factory space and working capital for an American worker. Du Pont's average operating investment per employee is $17,800.

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PARTICLES . . .

(*Continued from page* 7)

ried away from the nucleus by the electron is carried away by the neutrino. The higher the velocity of the ejected electron, the lower velocity of the neutrino, until for electrons ejected with the maximum velocity observed, the neutrino can be assumed to be ejected with little or no velocity, so that the energy it carries off is the energy equivalent of its mass. (Energy is equivalent to mass, the two being related by the famous equation $E = MC^2$.)

The maximum energy of the electron can be measured, and the change in energy of the nucleus can, too. Subtracting one from the other should then give the energy equivalent of the neutrino's mass.

It turns out, however, that the two are so close together in value that subtracting one from the other gives a value much smaller than the uncertainty in the measurements, so that all we have found out is that the neutrino's mass is very small.

So here we have the picture of the neutrino as it was first postulated in the early Thirties, and substantially as it stands today—a particle with a spin of a half unit and a very small mass.

Carrying on the usual method of science, it should be possible to predict from this picture certain things that should be observed, and then go out and try to observe them. This has been done successfully, though the first such observations of predicted results were made in rather esoteric fields, which I will not try to explain here.

However, there are a few very straightforward predictions which can be made from the neutrino hypothesis and which are subject to test.

Perhaps the most appealing of these is an effect known as inverse K-capture. You have perhaps noticed that all the evidence we have for the existence of the neutrino comes from situations in which we infer that a neutrino has been produced, and none of it from the interaction of free neutrinos and matter. Many people tend to disbelieve in the existence of the neutrino because they have never seen the effect of its hitting something.

—*K-Capture*

K-capture is a reaction in which the nucleus of an atom captures one of the electrons orbiting around it (in the *K* shell) and emits a neutrino. Inverse *K*-capture is the hypothetical reverse reaction, in which a neutrino strikes a nucleus and causes an electron to be emitted. If it is true that neutrinos are emitted in *K*-capture, then it follows that we ought to observe inverse *K*-capture from time to time.

It has never been observed. However, this does not disprove the neutrino hypothesis, since it has been calculated that, on the average, a neutrino must go through solid matter for a distance equal to 100,000,000 times the distance from the earth to the sun before it undergoes inverse *K*-capture.

Another effect of a neutrino hitting something would be the ionization of air by neutrinos striking the orbital electrons of the atoms. This has been looked for recently near atomic piles which should be strong neutrino sources, but it, too, has not been observed. This reaction is also a very improbable one, however.

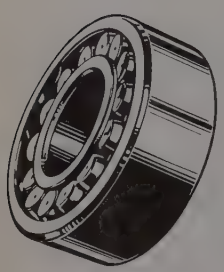
Two very straightforward predictions from the neutrino hypothesis are being investigated here at the University of Illinois, which is rapidly becoming the neutrino capital of the world.

U. of I. Research

One of these, being investigated by a group of experimenters under Dr. J. S. Allen, has to do with a *K*-capture process. It is predicted from the neutrino hypothesis that if a single neutrino is emitted in *K*-capture, the nu-

(*Continued on page* 24)

What is
"METALLURGY"
in a bearing



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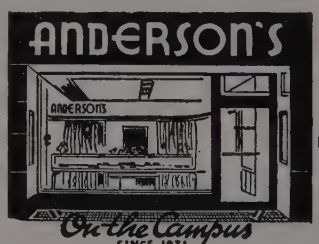

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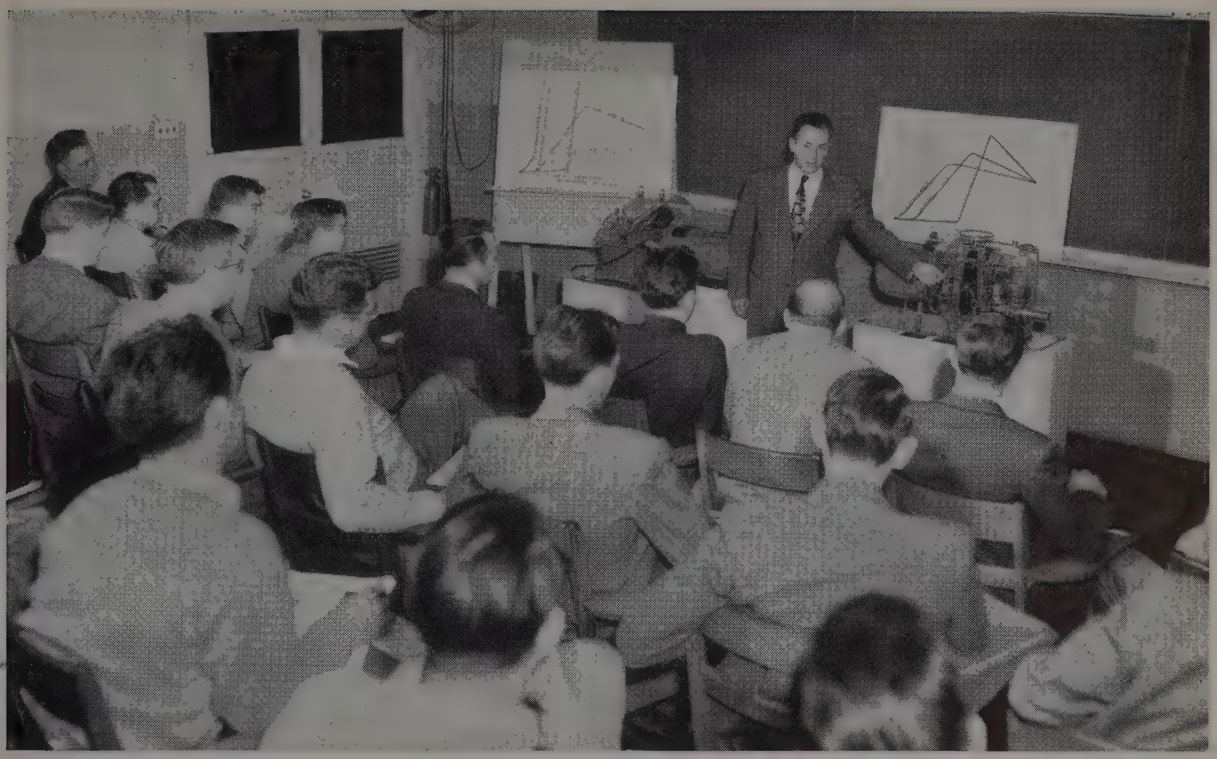

"Gladly wolde he lerne, and gladly teche"

—Chaucer, "Canterbury Tales"

THESE "students" are Standard Oil lubrication specialists, skilled and experienced in the use of modern lubricants. They are representative of the groups who come year after year from throughout our territory to keep up to date so that they can do a better job of serving our customers.

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This scene is typical of the two-way flow of information that goes on constantly throughout Standard Oil and its subsidiary companies. From our technically trained men, Standard Oil men in the field learn the practical applications of scientific improvements. From the field men, our scientists receive a wealth of specific performance reports and suggestions that make their work more productive and more useful.

The free interchange of ideas is part of the favorable intellectual climate in which Standard Oil technical men work. Such a system provides real benefits for Standard Oil and its customers. But perhaps most important of all, it is a system that profoundly stimulates and satisfies the scientists who participate in it.

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STANDARD

PARTICLES . . .

(*Continued from page* 22)

cleus of every atom undergoing K-capture will recoil away from the site of the reaction at a single definite velocity.

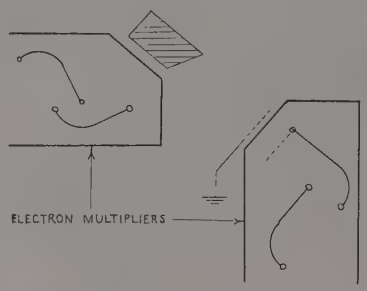
This prediction has not been verified until now because the velocity of the recoiling nuclei is very low, and very hard to measure. Solid radioactive material cannot be used as a source because this low velocity is subject to large, unpredictable changes when the nuclei leave the surface of the material.

The experimenters here are using the apparatus shown in the drawing with this article. It is filled with a radioactive gas, whose atoms are undergoing K-capture.

In the drawing, you can see that two electron multipliers are used. The multipliers are there to detect the electrons and recoiling nuclei. If an electron or recoiling nucleus strikes the first plate of a multiplier, it knocks a few electrons out of the surface of the plate. These electrons are drawn to the second plate, which is positively charged with respect to the first, and when they strike it, each of them knocks a few electrons out of its surface. These in turn are drawn to the third plate and the process continues down the multiplier until at the end you have a measurable pulse of electric current.

The apparatus does nothing until a reaction takes place in just such a manner as to send an electron into the multiplier on the left and a recoil nucleus into the one on the right. This can only happen if the reaction occurs in the volume which is shown shaded in the drawing, so that the position of the reaction is fixed within sufficient accuracy. The multiplier on the left is protected by a positively charged grid, so that it responds only to electrons; the one on the right has a negatively charged first plate, and responds only to positively charged recoil nuclei.

The electron reaches its electron multiplier first. The velocity of the electron is so much greater than that of the nucleus that the nucleus has only moved a negligible distance by the time the electron has started a pulse going down the multiplier.



Schematic diagram of electron multipliers used in neutrino research.

Then, when the recoil nucleus reaches the first grid of the other multiplier, it is accelerated rapidly by a negative potential on the second grid and strikes the first plate of its electron multiplier a negligible amount of time later.

The pulses from the two electron multipliers are sent into a timing circuit similar to those used in radar. This circuit has been carefully calibrated to measure the difference in time between the initiation of the two pulses in the electron multipliers, so that it actually measures the time of flight of the recoiling nucleus.

The distance from the shaded area to the grid on the electron multiplier is known, and now the time required for the nucleus to travel that distance is known. From these two pieces of information the velocity of the nucleus can be calculated.

The results so far show that most of the nuclei are going at the predicted velocity.

Another Phase of Research

Dr. C. W. Sherwin of the Physics department here has been using a similar method to verify other predictions from the neutrino hypothesis. He has used a thin solid sheet of radioactive material undergoing beta decay instead of a gas undergoing K-capture, and a beta ray spectograph to measure the momentum of emitted electrons replaces the first electron multiplier. Several mica windows are left in the apparatus, allowing the momentum of electrons to be measured at several angles. About the same method is used to measure the velocities of recoil nuclei as is used in Allen's apparatus. Once their velocities are known, their momenta can be calculated, since their mass is known.

What Sherwin is trying to do is to measure both the energy and the momentum of the neutrinos emitted in beta decay, and to see if they are related as the momentum and energy of a small, high-velocity particle should be related.

With the apparatus used, the momentum of both the recoil nucleus and the electron can be measured for several angles between the paths of the two. These two momenta can then be plotted as vectors. The momentum of the nucleus was zero before the reaction occurred. Therefore, by the conservation of momentum, the momentum of the nucleus, the electron, and the neutrino must add to zero after the reaction. The momentum of the neutrino, then, is the vector which closes the vector diagram.

(*Continued on page* 26)

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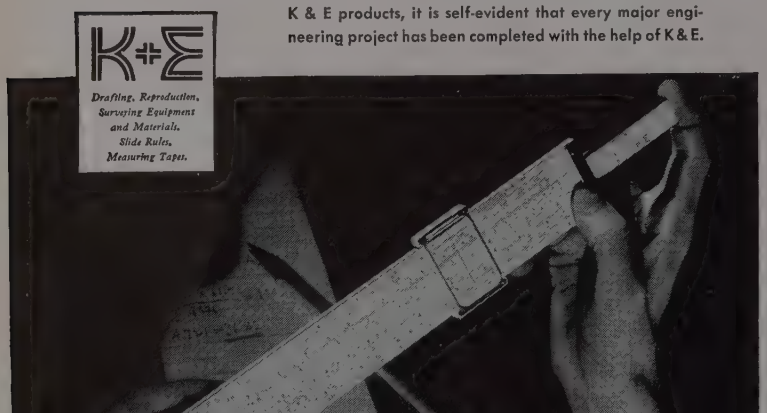

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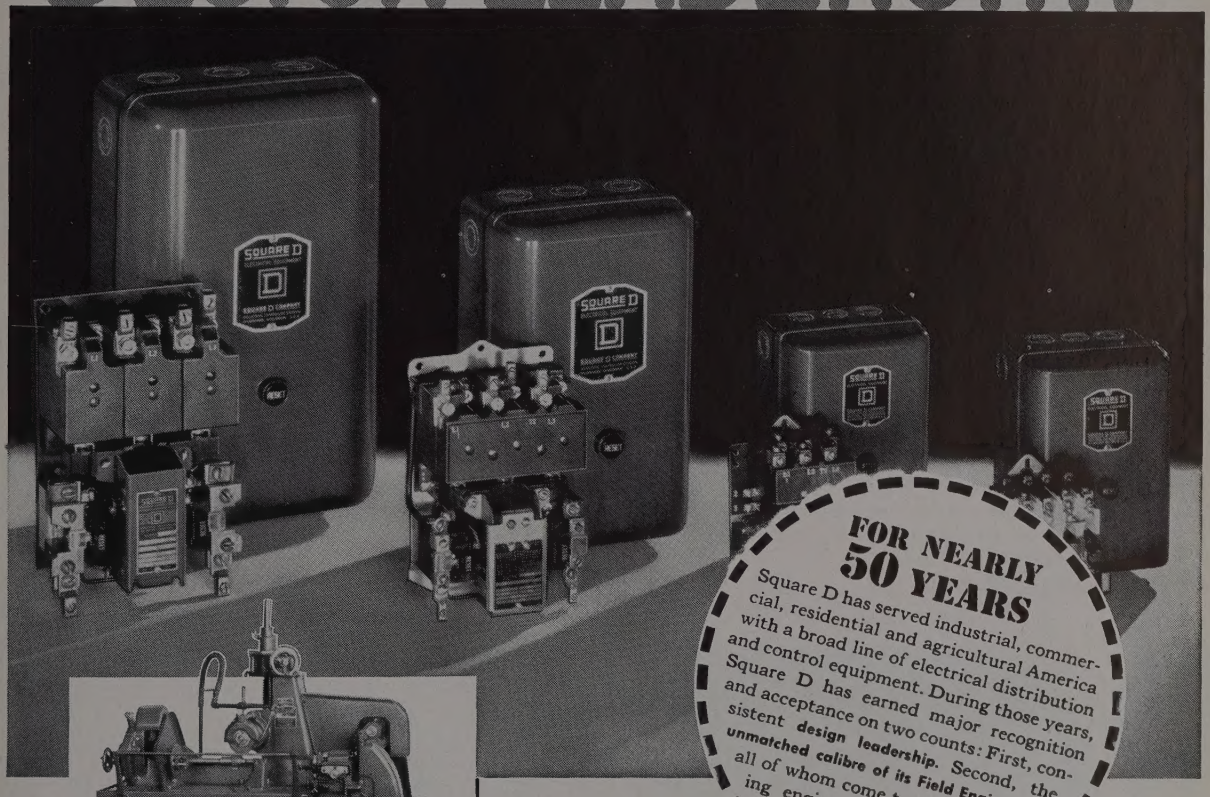

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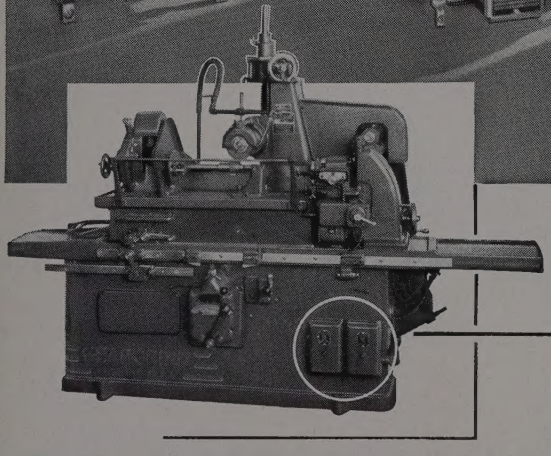

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LAMPS . . .

(*Continued from page* 10)

frequently cause radio interference. This interference may reach the radio through three channels: (1) direct radiations from the lamp, (2) direct radiations from the supply line, and (3) feed-back through the supply line.

One of the big drawbacks which seems to limit the use of fluorescent lamps in the home is the high initial cost of the installations. This high cost is due chiefly to the auxiliary equipment required for the fluorescent lamp. However, in most cases, the high initial cost is offset by the eventual savings in power consumption which result from replacing incandescent with fluorescent fixtures.

Originally, one of the chief objections to the use of the fluorescent lamp in many applications was that of its color qualities. The light from the standard lamp is deficient in light output in the red portion of the visible spectrum. Recently, however, a new type of phosphor coating was discovered which gives a much higher output in the red end of the spectrum. Consequently, colored objects appear more in their true nature when viewed under light produced by these new "De Luxe" lamps, as they have been named.

The fluorescent lamp produces a unique source of light—a source which is a far cry indeed from the first incandescent lamp produced by Edison. While it is still unperfected, constant research is bringing new developments into play, and from all appearances, the fluorescent lamp is destined to be the favored means of producing artificial light for several years to come.

PARTICLES . . .

(*Continued from page* 24)

The energy of the neutrino is calculated by finding how much of the change in energy of the nucleus during the reaction is not accounted for by the energy of the electron. (The kinetic energy of the electron can be found from its momentum.)

Now both the energy and the momentum of the neutrino are known. Relativity relates the energy and the momentum of a small, high-speed particle by the equation $E = cp$, where E is the energy of the particle, p is its momentum, and c is the velocity of light. If the energies of the neutrinos are plotted against their momenta, the result should be a straight line of slope c.

This has been done, and the result was exactly what was predicted: a straight line whose slope is the velocity of light.

The same apparatus has been used to study angular correlation; that is, the tendency of the recoiling particles to appear at certain angles to one another more frequently than at others.

Even from this abbreviated article, it should be plain that the neutrino has a pretty substantial reality in spite of its rather ghostly characteristics. And much of the research that has given this particle reality was done and is being done by University of Illinois scientists.

Joe: Why don't little devils eat ice cream cones?

Moe: I don't know.

Joe: Where in hell would they get them?

* * *

Judge: "You admit you drove over this man with a loaded truck?"

Engineer: "Yes, your honor."

Judge: "And what have you to say in your defense?"

Engineer: "I didn't know it was loaded."

* * *

He: "Drinking makes you beautiful."

She: "But I don't drink."

He: "But I do."

When the country's largest railroad loudspeaker system was planned in the Baltimore and Ohio's yards near Chicago, the choice of cable to be used was a key factor. With 37 miles of underground cable involved, subsequent maintenance costs could conceivably be a major item if any but the best cable were to be used.

Okonite cable was chosen for this job because of its superior rubber insulation and the resistance of its Okoprene sheath to alkalis, acids, oils and other corrosive substances encountered in railroad yard installations. Today, 197 two-way loudspeakers, 50 paging speakers, a complete telephone and printing telegraph system, and an independent inter-communicating system between offices in the yard are operated over Okonite cables in this network.

● ● ●

Tough jobs are the true test of electrical cable . . . and installations on such jobs usually turn out to be Okonite.

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Aluminum melts at 1217° F....

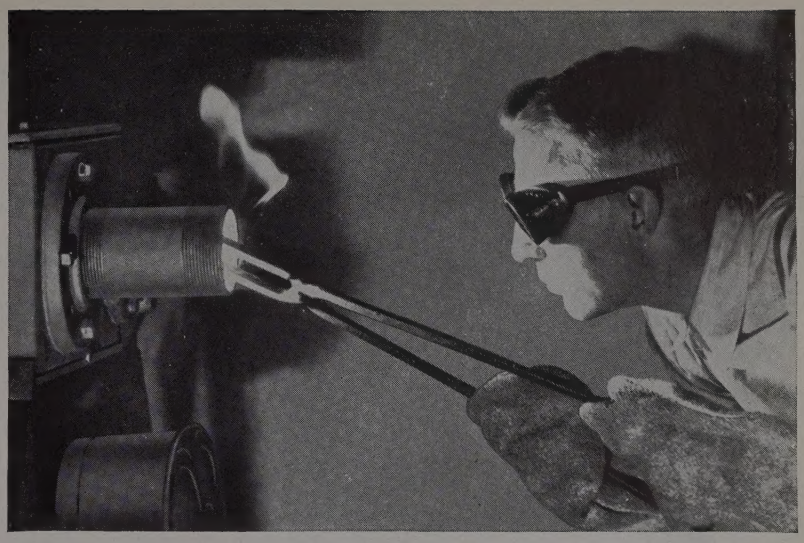
What's the melting point of fused aluminum oxide?

- ☐ *1652°F.*
- ☐ *2732°F.*
- ☐ *3272°F.*
- ☐ *3722°F.*

Not 1652°F. which is a bright red heat; nor 2732°F. which is white heat; nor 3272°F., the highest temperature in a blast furnace.

Yes, the melting point of fused aluminum oxide (as made by Norton from the mineral bauxite under the registered trade-mark Alundum) is 3722°F. That's why it's such a popular refractory material. Because it also possesses high thermal conductivity and low electrical conductivity when hot, it is used extensively in both fuel and electrically heated furnaces.

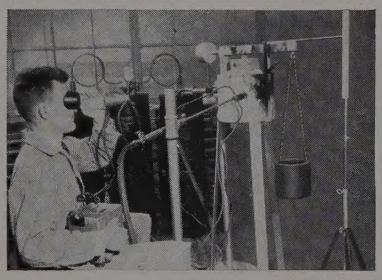
In the Norton Mechanical Laboratory W. M. Wheildon, Jr., B. S. and M. S., Massachusetts Institute of Technology '30 and '31, takes readings on a wear-testing machine which he developed.



Harder Than Cemented Tungsten Carbide

Alundum grains in various crystalline structures are widely used as abrasives. On the Knoop scale, they have a hardness of 2000, the same as the sapphire.

As the world's largest manufacturer of abrasives, Norton has worked wonders with Alundum grains. Highly skilled, college-trained research men in Norton's laboratories have succeeded in giving to Alundum abrasives a wide range of physical properties by controlling the size of crystals and their chemical and physical properties.



In the Norton Ceramic Laboratory O.J. Whittemore, Jr., B. S., Iowa State '40, operates a load test furnace of his design — a furnace that tests refractories at temperatures up to 2450°C.

32 Alundum Abrasive

The crowning achievement in aluminum oxide chemistry was the creation by Norton of a unique single-crystal grain structure of unusual sharpness. Named "32 Alundum," it has been hailed as the "greatest abrasive contribution to increased grinding production in more than 40 years."

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NAVY PIER . . .

(*Continued from page* 11)

vitations are offered to new archies and also any of those from downstate.

ASCE

At the monthly meeting of the Navy Pier chapter of the American Society of Civil Engineers, held Tuesday, February 20, the engineers assembled heard a report by Mr. A. L. R. Sanders, chief engineer of Hazlett and Erdahl, consulting engineers, on the new bridge over the Mississippi river at East St. Louis, Ill.

Mr. Sanders illustrated his talk with colored slides showing the progress of the work. The structure involves several grade separations and the crossing of the river.

ASME

The main aim of the Pier branch of the ASME this semester, is to try to introduce and enlarge its members' perspective on the different parts of industry. They hope to present many speakers, representing a variety of industrial ideas and operations.

This plan of obtaining speakers from many phases of industry, which we placed first emphasis on last semester, is now in full swing. Thus far, they have covered topics ranging from "Bikini, the Human Side," to a field trip through a magnesium foundry and International Harvester. As part of their program they also hope to have films on technical subjects, discussions and field trips.

SOCIETIES . . .

(*Continued from page* 16)

7:15 p. m. in 201 Agricultural Engineering building. All agricultural engineers, particularly the freshmen and sophomores, are urged to attend the meetings of their society on these new dates. Movies on torch welding of aluminum and soil erosion were shown, and refreshments served after the business meeting.

ETA KAPPA NU

The spring semester officers of Eta Kappa Nu are as follows: Eugene Mueller, president; Abraham Goo, vice-president; Lloyd Ward, recording secretary; Dick Storer, corresponding secretary; Ted Wright, treasurer; Ivo Herzer, Bridge correspondent.

During the semester, the honorary holds business meetings, helps plan the afternoon EE coffee hours, and makes an award to the outstanding senior engineer in EE.

SIGMA TAU

This all-engineering fraternity met on February 20 and elected the following officers for the coming semester: Jack Ritt, president; Hank Kalapaca, vice-president; Elwood Schmidt, secretary; Jim Kay, treasurer; LeRoy Smith, corresponding secretary; Ed Wolff, historian.

Two drunks were whizzing down the road.

"Shay, look out there, Joe. You almost ran into that telephone pole."

"Who, me? I thought you were driving!"

* * *

A frosh approached a cigar counter and said: "I usually smoke that brand in the can."

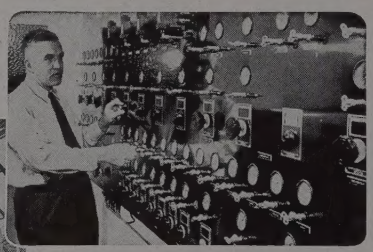
"And that's the best place to smoke them," replied the sweet young thing behind the counter.

* * *

Soph EE: "What's Prof. Smith talking about?"

Soph ME: "Integration, you dimwit!"

Soph EE: "Well, is he for it or against it?"

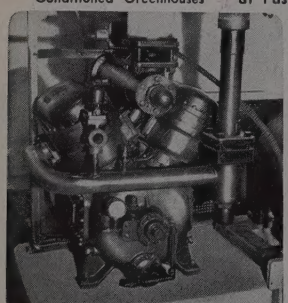


Dr. Frits Went at Control Board of the Plant Laboratory

Inside One of the Six Air Conditioned Greenhouses

$407,000 Phytotron Laboratory Equipped with Frick Refrigeration

The great new plant research laboratory of the California Institute of Technology, at Pasadena, uses two Frick refrigerating machines for cooling four rooms and air conditioning 13 others, plus six greenhouses. Simulated weather conditions are automatically controlled with ease and accuracy. Installation by the Independent Refrigeration Co., Los Angeles.



Frick NEW "ECLIPSE" Compressor at the Phytotron

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, offers a career in a growing industry.

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